State of Wisconsin/Department of Transportation

RESEARCH PROGRESS REPORT FOR THE QUARTER ENDING: Dec 31, 2002

Program: SPR-0010(36) FFY99	**Part: II Research and Development**
Project Title: Structural Analysis of Sign Bridge Structures and Luminaire Supports	**Project ID:** 0092-00-16
Administrative Contact: Nina McLawhorn	**Sponsor:**
WisDOT Technical Contact: Error! Bookmark not defined.	**Approved Starting Date:** May 3, 2000
Approved by COR/Steering Committee: $49,969.00	**Approved Ending Date:** Nov 28, 2003
Project Investigator (agency & contact): Christopher Foley: Marquette University	

Description: The study will be conducted over 34 months, and will include 13 tasks completed in four (4) phases.
Phase I: Wind Loading and WI DOT Inspection Procedures
Task 1: Obtain and Review Records/Data
Task 2: Transform Computed Static Wind Pressure Data
Task 3: Synthesize/Scruntinize Research Results for Proposed Research
Task 4: Crack Detection Feasibility Study
Phase II: Luminaire Support Research
Task 5: Re-examination of Failure Investigation Findings
Task 6: Synthesize Results of Past Research
Task 7: Revisit Wind Velocity Relationship to Luminaire Support Failure
Task 8: Develop Inspection Protocols
Phase III: Overhead and Cantilevered Sign Bridges
Task 9: Data Investigation/Analysis
Task 10: Field Visits
Task 11: Qualitative Estimates of Actual and Proposed Data
Task 12: Failure Investigations and Replacement Strategies
Task 13: Experimental Testing
Phase IV: Research Report to WI DOT

Background:
The scope expected for the research can be broken down into two parts. With reference to luminaire supports, the research will seek to develop inspection guidelines to assess the need for replacement and/or retrofit of both high-mast and standard luminaire supports. The research related to sign bridge structures should address the following: (a) determination of the causes of the stress cracking in the sign bridge elements; and (b) an attempt to correlate stress-crack severity and/or location to structural integrity. Specific sign bridges to be considered are included at the end of this problem statement. The results of (a) and (b) should be used to develop inspection criteria for the determination of retrofit and/or replacement of the structure. Finally, the sign bridge research should address the effect of the T-stub truss bridge support retrofit detail on future performance of the modified truss bridge.

Total Study Budget	Current FFY Budget	Expenditures for Current Quarter	Total Expenditures to Date	Percent Complete
$49,969.00	**$9,993.80**	$0.00	**$25,646.74**	**0 (%)**

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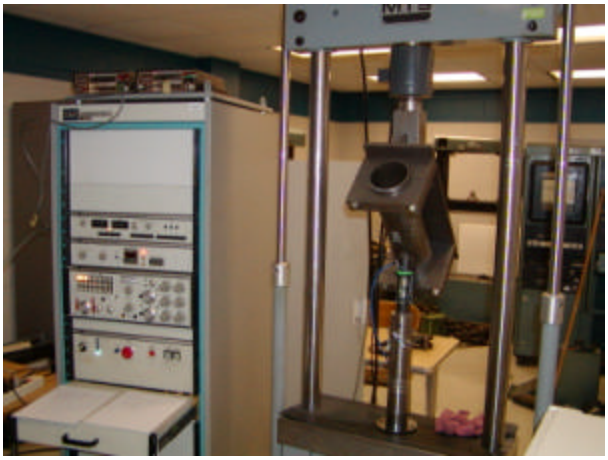
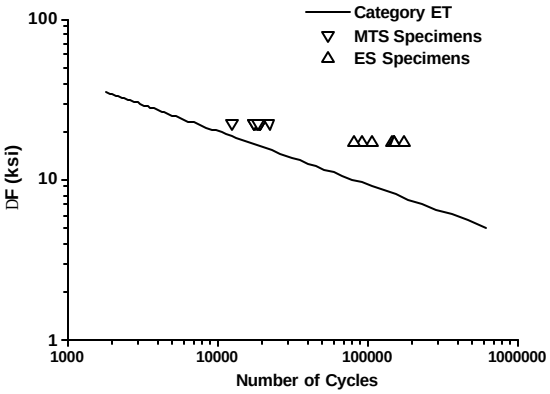
Progress This Quarter:
(Includes project committee mtgs, work plan status, contract status, significant progress, etc.)

The fatigue testing of the k-joints as described in last quarterly report have been completed. The testing arrangement and S-N data results are given below. The results of this fatigue testing has been discussed with researchers at the University of Minnesota for incorporation in NCHRP research efforts that are on-going.





Two test specimen configurations were tested. The first group denoted MTS were fabricated specimens constructed using A513B DOM material. Twelve specimens were fabricated and tested. This was not the material of choice for the testing, but it is what was provided by the steel fabricator. This fabricator is currently providing duplicate specimens fabricated using A53 B material that would normally be specified for sign support structures. There is no time available to perform testing of this second group. The results are not expected to be effected by the material change since it has been shown that the S-N behavior of welded steel joints are relatively insensitive to the steel material composition.

The second specimen grouping is denoted as ES and these specimens were cut from an existing sign support structure decommissioned. This structure was located immediately north of Miller Park and it spanned three lanes of eastbound IH94. The material for these specimens was determined using chemical composition analysis as well as tensile testing. The material is consistent with A53 B pipe material. Eight existing steel specimens were tested.

The results of the fatigue testing are also illustrated above. As shown, both groups adhere quite nicely to the category ET detail found in the AASHTO sign and luminaire design specifications. The statistics (mean and coefficient of variation) are currently being developed and the statistical distribution for the data is being identified. This will allow fatigue life predictions to be generated for structures that involve these joints.

Work Next Quarter:

The technical report for the work is currently being written. The report is broken down into three phases:

Phase I: *Structural Analysis and Fatigue-Life Prediction of Overhead Full-Span Sign Support Structures*. The report for this phase is being written by Mr. Scott Ginal of Graef Anhalt Schloemer and Associates. This report is his MS thesis. The technical report for this phase will be authored by C.M. Foley and S.J. Ginal. An executive summary of this phase of the work is being prepared and it will be assembled with the MS thesis document as a stand-alone report. The report will discuss fatigue life prediction in the absence of statistical data for the welded pipe joints found in the structures studied. This report is nearly complete and it is hoped that a draft will be available by February 28, 2003. The PI will keep WisDOT informed of progress on this front.

Phase II: *Structural Analysis and Fatigue-Life Prediction of High-Mast Luminaire Support Structures*. The research report for this phase will be a stand-alone report authored by C.M. Foley. It will include its own stand alone executive summary and content. This report is currently under preparation and a draft will be available on February 28, 2003 for WisDOT review.

Phase III: *Fatigue Performance of Welded K-Type Joints of Round HSS Components*. This research report will provide detailed discussion of the fatigue testing of the K-configuration welded pipe joints conducted as part of this research. The report will discuss S-N data, fractographic examination, hardness testing, and material composition testing performed. Statistical description of the S-N data will be included in the report and this data will be used to revise the fatigue life predictions made in Phase I. This work is being carried out by Mr. John Peronto as an MS thesis in the Department of Civil and Environmental Engineering at Marquette University. As such, this report will be authored by John L. Peronto and C.M. Foley. Unfortunately, this report will be available in late June 2003. Mr. Peronto is pursuing a double major in civil engineering and mechanical engineering and will complete his MS in five years. He is making significant progress on the research and completion is imminent, although delayed to the semester's end.

Circumstances affecting progress/budget:

There are no circumstances that will affect the budget for the project. All pertinent research has been completed.

Gantt Chart:

No GANTT chart is provided since the research is complete

Note: Gantt chart shown in State Fiscal Year Quarters